RHODE ISLAND

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Program Description

The importance of biological assessments in the evaluation of water quality has long been recognized in Rhode Island. Biological assessments are used to supplement physical and chemical water quality monitoring data. More specifically, the biological data can be used to identify long-term trends in water quality which reflect water pollution abatement efforts and/or needs. The Rhode Island Department of Environmental Management (RIDEM), Office of Water Resources (OWR) has two types of biological monitoring programs. Multiple plate artificial substrates have been used to evaluate the biological community in deep rivers since 1974. In addition, EPA's Rapid Bioassessment Protocol (RBP) (USEPA 1989) has been used since 1991 for the assessment of the biological integrity of various shallow river sites in the state.

Artificial Substrate Monitoring
The Fullner multiple-plate artificial substrate with 14 plates has been used by the Office of Water Resources for over 20 years to assess instream biological communities. Stations selected for this biological monitoring include those used for USGS trend chemical sampling to more closely relate chemical and biological data. This method has the advantage of providing a uniform sampling habitat for each station, thus reducing the problem caused by varying types of river bottom and depth. Macroinvertebrates collected on the artificial substrates are classified according to their tolerance of pollutants.

Rapid Bioassessment Protocol Monitoring
RBP monitoring involves an integrated assessment, comparing habitat (physical structure, flow regime) and biological measures with defined reference site conditions. Since 1992, a network of 45 stream riffle-area sites have been surveyed by Roger Williams University in cooperation with and contracted by RIDEM. Each site is visited during the spring-summer season and macroinvertebrates are sampled (minimum 100 organisms per site visit where feasible). Data are analyzed using RBP I and II protocols, which include varying degrees of field and laboratory organism identification.

The streams sampled within the state range from first order to fifth order. Eight of the streams are considered to be first order, eighteen second order, twelve third order, four fourth order and three are of the fifth order. Lower order streams are quite dependent upon the immediate characteristics of the watershed. In other words, runoff is a direct-affect component versus one of many components within a higher order stream. It is important to note that the 1993, 1995 and 1997 sampling events took place during drought conditions, which may have resulted in fewer riffles, lower dilution and lack of runoff. This probably affected the types of organisms collected and resulted in an altered picture of the stations based from that seen in other years. This information was taken into account during the evaluation of the biological assessments.

Initial bioassessment work involved establishing and field testing the RBPs in Rhode Island streams and rivers. In addition, refinement of the protocol over the past 4 years has established the presence of two sub-ecoregions within the state: coastal areas and inland areas. Incorporation of the presence of these two sub-ecoregions into selection of reference sites and application of the protocols will continue. The habitat/physical parameters and biological metrics of each station were compared to those of the selected reference station and given an overall bioassessment score.

Documentation and Further Information

*The State of the State's Waters Rhode Island Section 305(b) Report*, September 2000:
http://www.state.ri.us/dem/pubs/305b/index.htm

State of Rhode Island 2000 303(d) List of Impaired Waters, November 2000: http://www.state.ri.us/dem/pubs/303d/303d00.pdf

Water Quality Regulations (including WQS), amended June 2000: http://www.state.ri.us/dem/pubs/regs/REGS/WATER/h20qlty.pdf

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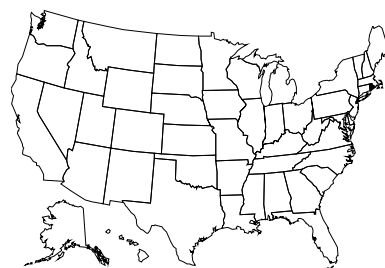
Programmatic Elements

Uses of bioassessment within overall water quality program	✓	problem identification (screening)
	✓	nonpoint source assessments
	✓	monitoring the effectiveness of BMPs
	✓	ALU determinations/ambient monitoring
	✓	promulgated into state water quality standards as biocriteria
		support of antidegradation
	✓	evaluation of discharge permit conditions
	✓	TMDL assessment and monitoring
		other:
Applicable monitoring designs	✓	targeted (i.e., sites selected for specific purpose) *(specific river basins or watersheds and comprehensive use throughout jurisdiction)*
	✓	fixed station (i.e., water quality monitoring stations) *(specific river basins or watersheds and comprehensive use throughout jurisdiction)*
		probabilistic by stream order/catchment area
	✓	probabilistic by ecoregion, or statewide *(comprehensive use throughout jurisdiction)*
		rotating basin
		other:

Stream Miles

Total miles *(determined using state based GIS coverage)*	**1,498**
Total perennial miles	979
Total miles assessed for biology*	**272.8**
fully supporting for 305(b)*	188.1
partially/non-supporting for 305(b)*	84.7
listed for 303(d)*	78.5
number of sites sampled *(on an annual basis)***	~62
number of miles assessed per site	site specific

272.8 Miles Assessed for Biology

188.1 miles
84.7 miles

🌀 "fully supporting" for 305(b)
☐ "partially/non-supporting" for 305(b)
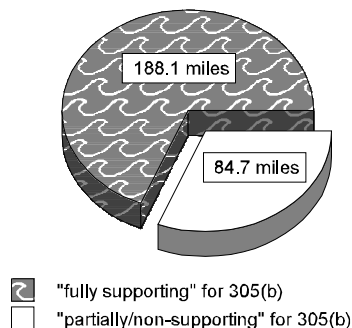
*These numbers represent the miles assessed for ALUS using biology or a combination of biological and chemical data. The miles listed for 303(d) were taken from the RI draft 2002 303(d) list for biodiversity impairments.

**Roughly 62 sites are monitored on an annual basis, though this number does vary (10 = artificial substrate; 45 - 50 = RBP).
Fifty-five additional sites were sampled in 2000 as part of a random sampling design for the EPA.

Aquatic Life Use (ALU) Designations and Decision-Making

ALU designation basis	Single Aquatic Life Use and Class System (A,B,C)
ALU designations in state water quality standards	One designation: fish and wildlife habitat
Narrative Biocriteria in WQS	No formal/informal numeric procedures are used to support narrative biocriteria; however, there is a qualitative and/or narrative scale of condition.
Numeric Biocriteria in WQS	none
Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)	✓ assessment of aquatic resources ✓ cause and effect determinations ✓ permitted discharges ✓ monitoring (e.g., improvements after mitigation) ✓ watershed based management
Uses of bioassessment/ biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU	Super-fund sites and Rhode Island Pollutant Elimination Discharge System (RIPDES) permit toxic elimination

Reference Site/Condition Development

Number of reference sites	**2** total
Reference site determinations	✓ site-specific ☐ paired watersheds ☐ regional (aggregate of sites) ✓ professional judgment ☐ other:
Reference site criteria	Minimally impaired/disturbed (best reference site in New England) – natural conditions, bank erosion, land use, etc. High Quality unimpaired condition for RBP or site-specific for special site studies.
Characterization of reference sites within a regional context	✓ historical conditions ☐ least disturbed sites ☐ gradient response ☐ professional judgment ✓ other: minimally disturbed*
Stream stratification within regional reference conditions	✓ ecoregions (or some aggregate) ☐ elevation ☐ stream type ☐ multivariate grouping ☐ jurisdictional (i.e., statewide) ☐ other:
Additional information	✓ reference sites linked to ALU ☐ reference sites/condition referenced in water quality standards ☐ some reference sites represent acceptable human-induced conditions

*Rhode Island's reference sites are considered minimally disturbed. The Wood River reference site (most widely used) will likely remain minimally disturbed because its watershed is largely contained within State Park boundaries. RI allows for about a 20% variation from that target for compliance. However, special watershed projects may be asking an upstream or downstream question and, therefore, may be required to find a least disturbed site within the unique segment for comparison.

Field and Lab Methods

Assemblages assessed	✓	benthos *(<100 samples/year; single season, multiple sites - broad coverage)*
	✓	fish *(sampled once in conjunction with USEPA: < 100 samples; single observation)*
		periphyton
	✓	other: macrophytes *(<100 samples/year; single season, multiple sites - broad coverage)*

Benthos	
sampling gear	collect by hand, multiplate, D-frame; 200-400 micron mesh
habitat selection	riffle/run (cobble), artificial substrate
subsample size	100 count
taxonomy	combination
Habitat assessments	visual based; performed with bioassessments
Quality assurance program elements	standard operating procedures, periodic meetings and training for biologists, taxonomic proficiency checks, and specimen archival

Data Analysis and Interpretation

Data analysis tools and methods	✓	summary tables, illustrative graphs
		parametric ANOVAs
		multivariate analysis
	✓	biological metrics *(aggregate metrics into an index)*
		disturbance gradients
		other:

Multimetric thresholds	
transforming metrics into unitless scores	25th percentile of reference population
defining impairment in a multimetric index	75th percentile of reference population - standard random sampling design, EPT index, RBPs

Evaluation of performance characteristics	✓	repeat sampling
		precision
		sensitivity
	✓	bias
		accuracy

Biological data	
Storage	databases, spreadsheets
Retrieval and analysis	EDAS